To: Sasha Bergman
Minnesota Public Utilities Commission
121 7th Place East, Suite 350
St. Paul, Minnesota 55101-2147

RE: In the Matter of the 2025 Minnesota Biennial Transmission Projects Report; Grid Enhancing Technologies Report; PUC Docket Number: E999/M-25-99

Introduction

Clean Grid Alliance, Fresh Energy, Sierra Club, and Minnesota Center for Environmental Advocacy (collectively, the Clean Energy Organizations or "CEOs") respectfully submit the following reply comments on the Grid Enhancing Technologies Report ("GETs Report") in MPUC Docket #E999/M25-99.

As the Commission is well aware, many challenges currently face our electricity system, including but not limited to the increasing saturation of intermittent resources, significant transmission constraints, increased load/demand, and complicated interconnection processes at the regional transmission operator level. While no one solution is available that can resolve all of these complexities, it is more critical than ever that planners, transmission owners, and utility commissions explore all available tools to improve grid operating conditions and hedge against financial and reliability risks associated with these challenges.

Grid Enhancing Technologies ("GETs") present one such available tool. GETs can offer near-term solutions to reduce transmission congestion constraints, increase headroom available to allow for faster interconnection of clean resources, and realize significant cost savings for retail electricity customers.

As an initial matter, commenters here note that a significant portion of the GETs report has been withheld from public review. Commenters understand that some of this information is sensitive and should not be publicly available. However, we question whether all of the information on pages 19-183 of the report must be protected as trade secret and we urge the Commission, in this and future reports, to require public release of information that does not require this designation in the interest of transparency and access.

GETs are well-established technology with proven success

Given the relatively few instances of GETs deployment (or planned deployment) in the GETs report, it is clear to the CEOs that the use of GETs in transmission planning has not been fully embraced by transmission owners in Minnesota. In the GETs Study Report, the Grid North Partners ("GNPs") state that "many of the remaining congestion concerns may not be as straightforward or inexpensive to solve even when considering GETs projects (especially considering the relative infancy of GETs technology use in Minnesota)" (p 12). This suggests that the GNPs consider the technology still in its pilot or trial phase, which is no longer accurate.

- The first large scale integration of dynamic line ratings ("DLR") into real-time and market operations in the US was deployed on PPL Electric's 230kV system in 2022. That installation avoided a $50 million rebuild project and saved over $23 million in congestion costs in its first year. [1]

- In 2023, AES deployed DLR sensors across five transmission lines in Indiana and Ohio. On one 345 kV transmission line, engineers estimated an average increase of 61% ampacity over the current static rating, and a 23% average increase over the Ambient Adjusted Ratings.[2] The team estimated that the deployment took only 9 months and $45,000 per mile for both the hardware and 20-year software license.

- As mentioned in the report, in 2024 Great River Energy deployed DLR technology on 10 transmission lines, which at the time was the largest DLR deployment in the nation. This deployment unlocked significant gains – a 22.5% increase in line capacity in the winter and 50.5% capacity increase in the summer. It is estimated that the installation has already saved GRE customers over $3 million.[3]

These successes, among others across the country, demonstrate that DLRs are ready for broad deployment today, and given their exceptional capacity increase to cost ratio, should be viewed as the first line of grid expansion rather than an alternative to be used in niche cases. In order to strengthen future GETs reports as well as encourage maximization of

[1] https://www.ampacimon.com/success-stories/the-first-u-s-electric-utility-to-integrate-dynamic-line-ratings-into-real-time-and-market-operations

[2] https://www.aes.com/sites/vault/files/2025-07/AES-LineVision-Case-Study-2024.pdf

[3] https://www.heimdallpower.com/news/whitepaper-one-year-gre, The installation found over 60% capacity increase during peak summer hours, but this additional capacity could not be used due to other limitations elsewhere on the system.

existing grid resources in the most cost-effective manner, the CEOs make the following recommendations for future reports.

Recommendations

Minnesota's GETs report should be viewed as an opportunity to maximize any and all available tools for increasing grid capacity. Some GET technologies are well-established, such as the use of DLR which has been implemented on many transmission systems and has shown proven results. Others, such as storage as a grid asset, are more nascent but should be considered and studied as they offer substantial benefits and are faster to implement than building new transmission.

The CEOs have reviewed comments filed in the above-referenced docket by the MN DOC and the WATT coalition. The CEOs are aligned with the comments of the DOC and the WATT coalition. Specifically, the CEOs agree with the comments of the DOC relating to the benefits analysis and the financial benefits associated with physical congestion relief (as opposed to financial hedging alone) such as the reduction of curtailment of renewable resources. However, we provide the following additional comments to build on the points raised by DOC and the WATT coalition.

1. **GETS can and should be reused for temporary construction.**

The hardware costs of DLR and topology optimization are often negligible compared to the savings from alleviating congestion during construction outages. Because of this fact, in 2024 MISO asked its transmission owners to consider using GETs during construction of Tranche 1 projects.[4] In addition, DLR may be moved from line to line relatively easily and therefore use to alleviate congestion due to temporary outages is a natural fit for this technology. It is not clear from the public report whether the anticipated congestion during construction planned over the next 5 years was considered an opportunity for GETs deployment. These outages may fall under the category for "Constraints Driven by Temporary Outages or Operations Conditions," but it also appears that this category was limited to constraints that had only one span of congestion.

2. **The modeling and analysis provided in the report can be improved**

The study completes a system-wide economic analysis using PROMOD, but PROMOD is limited to studying a small subset of system conditions that can be expected over the next 5 years. While this is a good start, the GNPs should incorporate GETs analysis into all

[4] https://cdn.misoenergy.org/MTEP24%20Near-Term%20Congestion%20Study%20Report657728.pdf

transmission project development processes as either possible alternatives or supplements during construction. This is especially true for advanced powerflow controllers and topology optimization which generally requires AC powerflow analysis to determine the true system impacts.

Further, the GNPs accurately note in the report that "it should be noted that PROMOD, as a simulation tool, has perfect foresight of future operating conditions and thus may underestimate congestion compared to historical actuals." We agree with this assessment, except to emphasize that PROMOD most certainly *does* underestimate congestion reduction benefits of GETs because the model does not capture operational inefficiencies that happen in real time under extreme outage conditions and these conditions are frequently where significant congestion costs are incurred.

3. **GETS need to be deployed programmatically, and not project-by-project**

GETs should be incorporated as programs rather than on a project-by-project basis. Deployment of GETs on a transmission system requires coordination between Operations, Planning, Engineering, IT, and MISO. This coordination and infrastructure should be developed today to allow for the incorporation of all GETs as they are deployed. The first meaningful step for all GNPs would be to create programs that establish the training, processes, and software needed to incorporate GETS technology into planning, standards, and operations. This includes coordination with MISO to ensure that the value offered by GETs are fed through to MISO market and reliability operations.

4. **Future reports should include additional technologies and more robust analysis.**

One thing that the GETs report has made clear is that there is significant room for increased consideration of DLRs, advanced powerflow controllers, and topology optimization and even more room for increased consideration of advanced transmission technologies ("ATTs") such as advanced conductors and storage as a grid asset. The report offers only a few examples where advanced powerflow controllers or topology optimization were identified as solutions or considered.

While DLR is often the most straightforward solution for addressing congestion caused by line ampacity ratings, when the terminal equipment is the limiting element, advanced powerflow controllers or Topology Optimization tools can more readily alleviate constraints. The CEOs encourage additional consideration of these technologies in future reports.

Powerflow controllers are only noted in **[TRADE SECRET INFORMATION BEGINS]** [redacted] **[END TRADE SECRET INFORMATION]** suggest that further analysis is required to support their deployment. Topology optimization is **[BEGIN TRADE SECRET INFORMATION]** [redacted] **[END TRADE SECRET INFORMATION]** It appears that these solutions were not adequately considered to address most or any of the grid constraints.

It is noted that "Constraints with High Congestion Only in Future Models" will continue to be monitored, but because they were under the 168-hour threshold historically, a GET deployment was not considered. This is an overly conservative stance given current load growth projections that are likely to exacerbate future congestion issues. GNPs should reconsider omitting these forecasted constraints because the future congestion is highly likely to meet or exceed the forecasts.

There are several notes throughout the report that GETs may be feasible to cost effectively address the constraints being evaluated, but that these solutions require further analysis to either determine their payback period or technical viability. For this report to drive actionable deployments, the GNPs need to provide complete viability and payback period analyses for all identified transmission constraints. This analysis should be fully completed in future iterations in the biennial transmission plan to ensure that the intent of the 2024 Minnesota Legislature is upheld and that all opportunities to increase reliability and save customers money are being pursued.

5. **Consideration of additional technologies**

Although the statute only names DLR, advanced powerflow controls, and topology optimization, it leaves open the door for condiseration of additional technologies. The CEOs encourage consideration of ATTs including advanced reconductoring and storage as part of the GETs and/or transmission reports.

- Advanced conductors: While "Advanced Conductors" were included in the definitions of the report and as a possible solution in one project, they were omitted from the majority of the analysis. Future iterations of the study should consider reconductoring with Advanced Conductors/High Performance Conductors.
- Battery and non-battery storage technologies: Storage as a grid asset ("SAGA," sometimes referred to as storage as a transmission only asset, or "SATOA") should be systematically considered as an ATT option and inclusion of these studies should

be included in future reports similar to how the Nobles Grid-Forming Battery Screening System Impact Study is included in the present 2025 Beinnial Transmission Projects Report.

Other forms of energy storage may be useful for relieving grid congestion while providing additional benefits to local communities. For example, a recent report[5] from the Great Plains Institute highlighted the potential of distributed ammonia production in Minnesota. Ammonia production facilities can offtake excess renewable electricity during times of grid congestion, functioning similar to a battery but producing ammonia for local use instead of storing electricity. This can help reduce congestion and facilitate additional renewable integration. Minnesota's robust agricultural economy makes it well-positioned to benefit from distributed ammonia technologies. While this is a relatively bespoke solution, it demonstrates the potential of alternative storage technologies to function as ATTs.

Future reports should consider the potential of a full range of storage technologies to function as ATTs. This should include lithium-ion batteries, green ammonia production, given its applicability to Minnesota, and other technologies that can benefit local economies in addition to the grid.

Storage may require adjustments to the payback-period analysis given its attributes can provide multiple benefits that may be beyond the scope of what is offered by DLR or other more traditional GETs. Similarly, advanced conductors may require adjustments to the cost/benefit analysis.

6. **The Commission should require standardized line and facility ratings methodologies and assumptions**

The GNPs provide well-supported arguments for a consolidated transmission report among all the applicable transmission owners in Minnesota (the system is highly interconnected, there are shared transmission paths, and the transmission plan for the state is a combined product). That same argument supports standardizing line and equipment rating methodologies and assumptions across the state to facilitate better shared learnings across the different transmission owners and better interoperability between GETs deployments.

[5] https://betterenergy.org/blog/report-unlocking-the-potential-of-distributed-green-ammonia-for-a-sustainable-rural-agricultural-future/

Conclusion

The CEOs appreciate the opportunity to provide comment on the GETs report. We look forward to seeing further analysis contemplated by this report and in future biennial transmission reports to the Commission.

Respectfully submitted this 2nd day of March, 2026.

/s/ Will Mulhern
Will Mulhern
Director, Electricity

Fresh Energy
408 St. Peter Street, Suite 350
St. Paul, MN 55102
mulhern@fresh-energy.org

/s/ Elizabeth Wheeler
Elizabeth Wheeler
Senior Counsel,
Director of Regulatory Advocacy

Clean Grid Alliance
3433 Broadway St. NE, Suite 240
Minneapolis, MN 55413
ewheeler@cleangridalliance.org

/s/ Amelia Vohs
Amelia Vohs
Climate Program Director
Minnesota Center for Environmental Advocacy

/s/ Patrick Woolsey
Patrick Woolsey
Staff Attorney
Sierra Club
2101 Webster Street Suite 1300
Oakland, CA 94612